PATENT SPECIFICATION

592,735

No. 13650/45.

Application Date: May 31, 1945.

Complete Specification Left: May 10, 1946.

Complete Specification Accepted: Sept. 26, 1947.

PROVISIONAL SPECIFICATION

Improvements relating to Linear Actuating Mechanisms

We, B. & P. SWIFT LIMITED, of North Circular Road, West Twyford, London, N.W.10, a British Company, RICHARD POLLARD, of 73, Woodcote Hurst, Epsom, Surrey, and ERIC ROBERT HOOKER, of 66, Vivian Avenue, Wembley, Middlesex, both British Citizens, do hereby declare the nature of this invention to be as follows:—

The present invention relates to linear actuating mechanisms of the kind in which linear movement is produced by the rotation of a screw spindle in a nut member or *vice versa*. With a view to allowing mechanisms of this kind to be set in advance for a specific job without the danger of intereference with the setting by accidental rotation of the longitudinally moving part, it is already known to provide a linear guide for the latter. For example, when the operated part consists of a tube having internal screw threads, longitudinal keyways have been provided on the outer side of the tube, which co-operate with a key located in a guiding bracket, which may itself have the shape of a sleeve surrounding the actuating spindle.

Although an actuating mechanism of this kind would generally be suitable for incorporation in the actuated mechanism without alteration, so that a limit switch or remote control device associated therewith may be supplied ready set, some subsequent adjustment may occasionally become necessary, and it is the object of the present invention to provide an arrangement which will allow such adjustment to be effected.

According to the principal feature of the present invention the linear guide element, instead of being rigidly connected with the frame of the actuating mechanism, is mounted rotatably thereon, while some locking means such as, for example, a set screw, which may co-operate with flats or grooves in the guide ring is at the same time provided for securing the guide ring in its position after it has been set.

In a preferred form of the mechanism according to the present invention, an actuating screw spindle is rotatably mounted in a gear casing. The latter is also provided with a flange, to which the actuating motor, for example an electric motor, is connected, with its axis parallel to the axis of the screw spindle, which it is arranged to drive through suitable speed-reducing gearing, accommodated in the gear casing. The rotatable screw spindle also carries within the gear box a part provided with small-pitch threads, which are utilised as a worm and co-operate with a worm wheel driving a movement-controlling device such as a limit-switch device or a part of a remote-control mechanism. On its outer face, opposite to the projecting end of the screw spindle, the gear casing is provided with a lug for connection into the operated mechanism, while the outer end of the screw spindle engages into internal screw threads provided at the adjacent end of a sleeve or thrust tube, which at the other end also carries a connecting element such as a lug. The thrust tube may have one or more longitudinal grooves or keyways on its outer side and passes through a guiding ring which is supported in the example by a sleeve-shaped bracket on the gear casing, keys or splines being provided in the guide ring which co-operate with the groove or grooves in the thrust tube so as to prevent the latter from rotation relative to the gear casing. Alternatively, the thrust tube may be formed with splines projecting from its outer surface, these splines being preferably made integral with the thrust tube so as to form a hollow spline shaft, while suitable longitudinal grooves are provided in the guiding sleeve to accommodate these splines. The lug which is carried by the thrust tube is preferably rotatably mounted on this tube. For example a sleeve-shaped part having an internal flange may be slipped over the end of the thrust tube, whereafter a flange is secured to the outer end of the thrust tube, the diameter of the latter flange being such as to let the sleeve, but not its flange, pass over it. Finally a plug portion with the lug proper is placed into the sleeve and secured therein so that the flange of the thrust tube is enclosed between the plug

[Price 1/-]

and the internal flange of the sleeve to which it is secured.

A thin-walled corner sleeve is preferably connected with the last-mentioned sleeve and arranged to project towards the gear casing for such a length that it will cover, even in the most extended position of the mechanism, the part of the thrust tube which extends beyond the guide ring. Packing is preferably provided in a groove at the outer surface of the guide ring so as to prevent dust from entering inside the cover sleeve. It will be seen that the cover sleeve will also assist in guiding the lug portion of the mechanism apart from completing a dust-proof enclosure for the actuating mechanism, the remaining part of the enclosure being formed by the sleeve-shaped bracket.

In order to enable the mechanism to be reset when it is mounted in the apparatus to be actuated, the sleeve-shaped bracket is not secured rigidly to the gear casing but is rotatably mounted thereon. For this purpose the end portion of this sleeve has a larger diameter than the remaining part of it, and a cap-shaped element is slipped over this enlarged portion and bolted to the gear casing. This cap-shaped element is shaped in such a manner as to form a bearing in which the sleeve-shaped bracket is rotatable, while the top portion of this cap-shaped element forms an internal flange projecting over the enlarged portion of the sleeve so as to prevent longitudinal movement thereof. A set screw is inserted into a reinforced portion of the wall of the cap-shaped element so as to engage with suitable recesses in the periphery of the enlarged portion of the sleeve-shaped bracket. It will thus be evident that when the set screw is tightened, the thrust tube with its actuating nut is prevented from any rotation, while, on release of the set screw it may be turned to effect a resetting, and then locked in its new position by retightening the set screw.

Various changes may be made in the details of the arrangement without exceeding the scope of the present invention. For example, the invention may be used with a different kind of drive, which may even be a manual drive.

Actuating mechanism according to the invention may be employed in a great variety of apparatus. Possible uses include as widely different fields as the actuation of ventilating shutters as well as flying controls in aircraft.

Dated the 31st day of May, 1945.
For the Applicants:
W. FULD.

COMPLETE SPECIFICATION

Improvements relating to Linear Actuating Mechanisms

We, B. & P. SWIFT LIMITED, of North Circular Road, West Twyford, London, N.W.10, a British Company, RICHARD POLLARD, of 73, Woodcote Hurst, Epsom, Surrey, and ERIC ROBERT HOOKER, of 66, Vivian Avenue, Wembley, Middlesex, both British Citizens, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The present invention relates to linear actuating mechanisms of the kind in which linear movment is produced by the rotation of a screw spindle in a nut member or *vice versa*, and in which a linear guide is provided for preventing rotation of the longitudinally moving part. Mechanism of this kind is known, in which the operated part consists of a tube having internal screw threads, while longitudinal keyways are provided on the outer side of the tube, which co-operate with a key located in a guiding bracket, which may itself have the shape of a sleeve surrounding the actuating spindle.

Although an actuating mechanism of this kind would generally be suitable for incorporation in the actuated mechanism without alternation, so that a limit switch follow-up control or remote-control device associated therewith may be supplied ready set, some subsequent adjustment may occasionally become necessary, and it is the object of the present invention to provide an arrangement which will allow such adjustment to be effected, which does not require interference with delicate parts such as the limit or other control device or contacts.

According to the principal feature of the present invention the linear guide element, instead of being rigidly connected with the frame of the actuating mechanism, is mounted rotatably thereon, while some locking means such as, for example, a set screw, which may co-operate with flats or grooves in the guide element, is at the same time provided for securing the guide element in its position after it has been set.

In order that the present invention may be more readily understood, an actuating device incorporating the invention by way of example will now be described more in detail with reference to the accompanying drawings, in which Fig. 1 is a side elevation of the actuator in section when

fully extended and Fig. 2 is a corresponding outside view of the actuator when partially extended.

Referring now to the drawings, an actuating screw spindle 1 is rotatably mounted by means of a ball bearing 3 in a gear casing 2. The latter is also provided with a flange 4, to which the actuating motor 5, for example an electric motor is connected, with its axis parallel to the axis of the screw spindle, 1.

Suitable speed-reducing gearing, 3, 5, 6, 7, 8, 9, is accommodated in the gear casing 2. The rotatable screw spindle 1 also carries within the gear casing 2 a part 10 provided with small-pitch threads, which are utilised as a worm and co-operate with a worm wheel 11 to drive a movement-controlling device 12 (see Fig. 2) such as a limit switch device or a part of a remote control mechanism. On its outer face, opposite to the projecting end of the screw spindle 1, the gear casing 2 is provided with a lug 13 for connection into the operated mechanism, while the outer end of the screw spindle 1 engages into internal screw threads provided at the adjacent end of a sleeve or thrust tube 14, which at the other end also carries a connecting element such as a lug 15. The thrust tube may have one or more longitudinal groeves or keyways 16 on its outer side and passes through a guiding ring 17 which is supported in the example by a sleeve-shaped bracket 18 on the gear casing 2, keys or splines in the guide ring 17 being arranged to co-operate with the groove or grooves 16 in the thrust tube 14 so as to prevent the latter from rotation relative to the gear casing 2. Alternatively, the thrust tube may be formed with splines projecting from its outer surface, these splines being preferably made integral with thrust tube so as to form a hollow spline shaft, while suitable longitudinal grooves are provided in the guiding sleeve to accommodate these splines. The lug 15 which is carried by the thrust tube is preferably rotatably mounted on this tube. For example a sleeve-shaped part 19 having an internal flange 20 may be slipped over the end of the thrust tube 14 whereafter a flange 21 is secured to the outer end of the thrust tube, the diameter of the latter flange being such as to let the sleeve 19 but not its flange 20, pass over it. Finally a plug portion 22 with the lug 15 proper is placed into the sleeve 19 and secured therein, for example by a pin or bolt 23, so that the flange 21 of the thrust tube 14 is enclosed between the plug 22 and the internal flange 20 of the sleeve 19.

A thin-walled cover sleeve 24 is preferably connected with sleeve 19 and arranged to project towards the gear casing 2 for such a length that it will cover, even in the most extended position of the mechanism, the part of the thrust tube 14 which extends beyond the guide ring 17. Packing 25 is preferably provided in a groove 26 at the outer surface of the guide ring 17 so as to prevent dust from entering inside the cover sleeve 24. It will be seen that cover sleeve 24 will also assist in guiding the lug portion 15 of the mechanism, apart from completing a dust-proof enclosure for the actuating mechanism, the remaining part of the enclosure being formed by the sleeve-shaped bracket 18.

In order to enable the mechanism to be reset when it is mounted in the apparatus to be actuated, the sleeve-shaped bracket 18 is not secured rigidly to the gear casing 2 but is rotatably mounted thereon. For this purpose the end portion 28 of sleeve 18 has a larger diameter than the remaining part of it, and a cap-shaped element 27 is slipped over this enlarged shoulder 28 and bolted to the gear casing 2. The cap-shaped element 27 is shaped in such a manner as to form a bearing in which the sleeve-shaped bracket 18 is rotatable, while the top portion of element 27 forms an internal flange 29 projecting over the enlarged shoulder 28 of the sleeve so as to prevent longitudinal movement thereof. A set screw 30 is inserted into a reinforced portion 31 of the wall of the cap-shaped element 27 so as to engage with suitable recesses 32 in the periphery of the enlarged diameter portion of the sleeve-shaped bracket 18. It will thus be evident that when the set screw 30 is tightened, the thrust tube 14 with its internal thread is prevented from any rotation, while, on release of the set screw it may be turned to effect a resetting, and then locked in its new position by re-tightening the set screw. Holes 33 allow the use of a hook spanner for the rotation of tube 14.

Various changes may be made in the details of the arrangement without exceeding the scope of the present invention. For example, the invention may be used with a different kind of drive, which may even be a manual drive.

Although the arrangement as so far described and illustrated permits to obtain a neat and compact design, the present invention is also applicable to linear actuator devices in which the functions of screw spindle and nut are changed over, that is to say in which for example a nut member is carried at the end of a rotary tube or sleeve member projecting from the gear casing, while the longitudinally movable part of the actuator dvice com-

prises a screw spindle which is held against rotation and is moved axially by the rotation of the said sleeve member.

Suitable linear guide means may again be provided which can take the frictional torque between the co-operating screw elements, and the longitudinally movable part can be provided with an eyelet which is free to rotate about the axis of the screw elements. Adjustment can be effected by an arrangement permitting, after release of locking means, relative rotation between the screw spindle and its linear guide means, in a manner similar to that described with reference to parts 27 to 33.

Actuating mechanism according to the invention may be employed in a great variety of apparatus. Possible uses include as widely different fields as the actuation of ventilating shutters as well as flying controls in aircraft.

Having now particularly described and ascertained the said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. Linear actuating mechanism of the kind specified, in which the linear guide element is rotatably mounted on the frame of the actuating mechanism while suitable locking means are also provided for the purpose specified.

2. Actuating device as claimed in claim 1, in which the longitudinally movable part carries at its end a connecting lug substantially perpendicular to its axis, this lug being rotatably secured to the longitudinally movable element substantially as described.

3. Linear actuating mechanism of the kind specified, substantially as described with reference to the accompanying drawings.

Dated the 10th day of May, 1946.

W. FULD,
For the Applicants.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press —1947. Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies, price 1s. 0d. each (inland) 1s. 1d. (abroad) may be obtained.

[This Drawing is a reproduction of the Original on a reduced scale.]

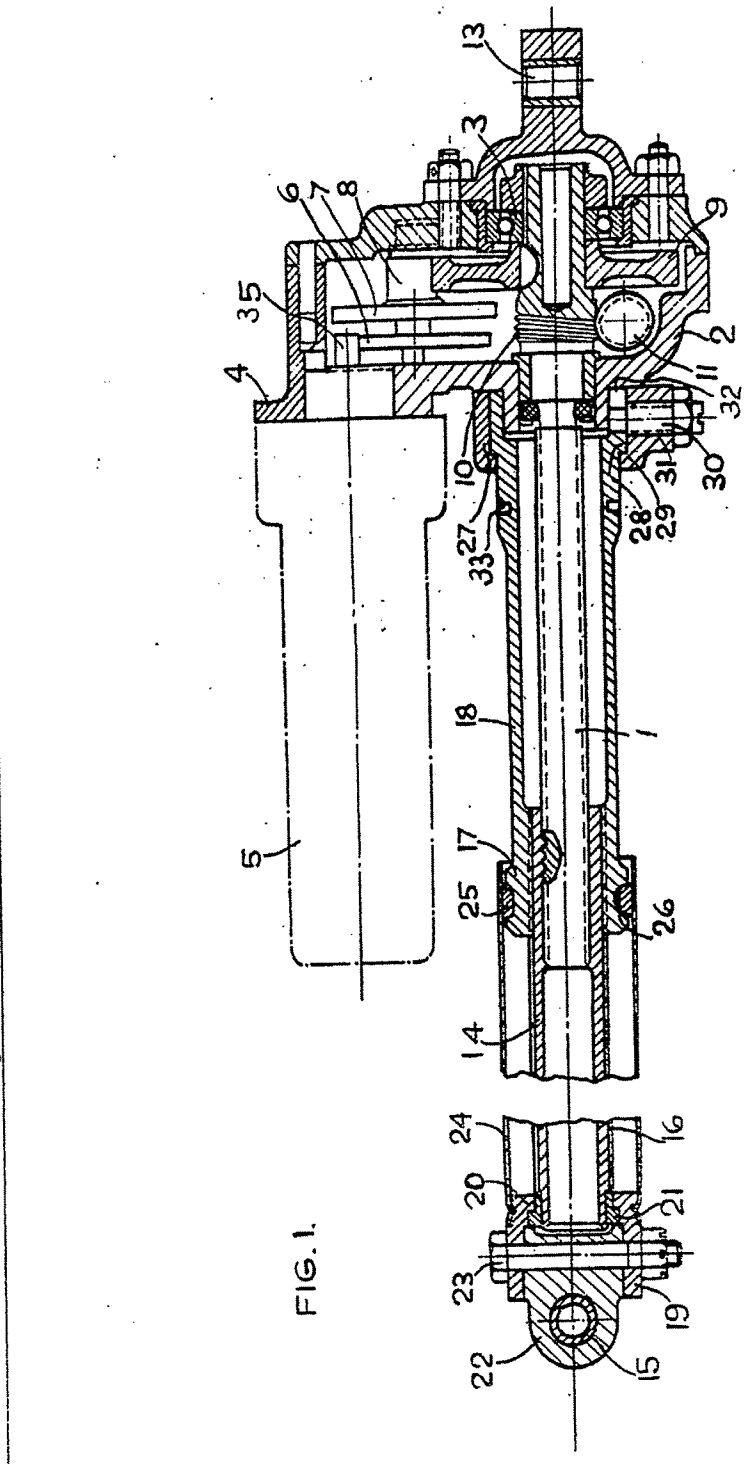


FIG. 1.

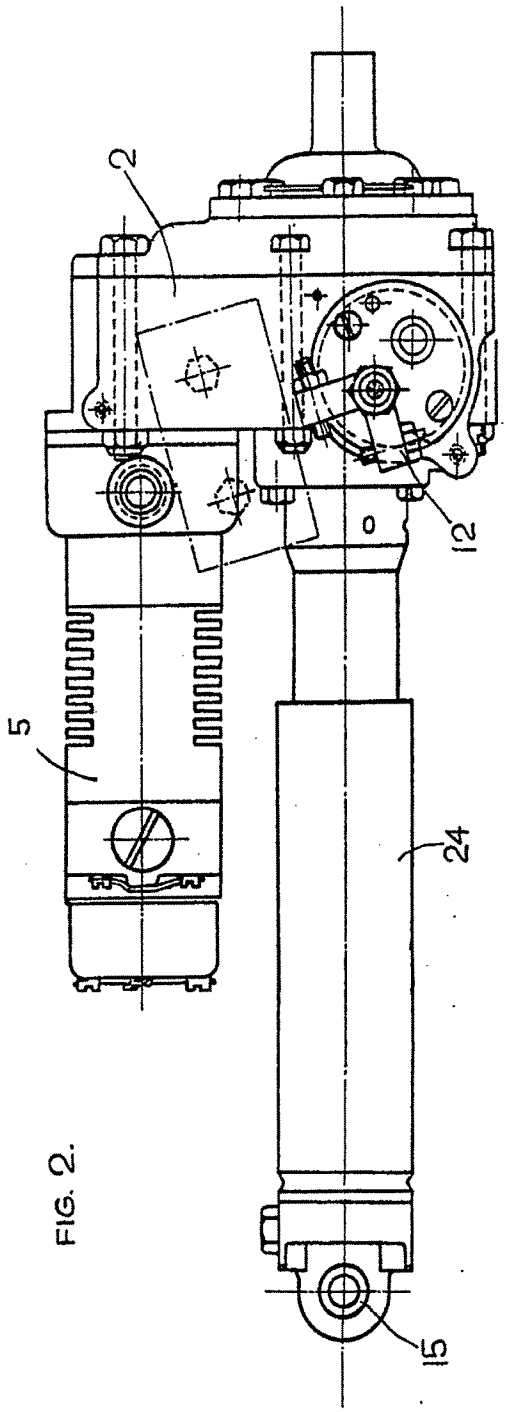


FIG. 2.

[This Drawing is a reproduction of the Original on a reduced scale.]

592,735 COMPLETE SPECIFICATION

SHEET 1

FIG. 1.

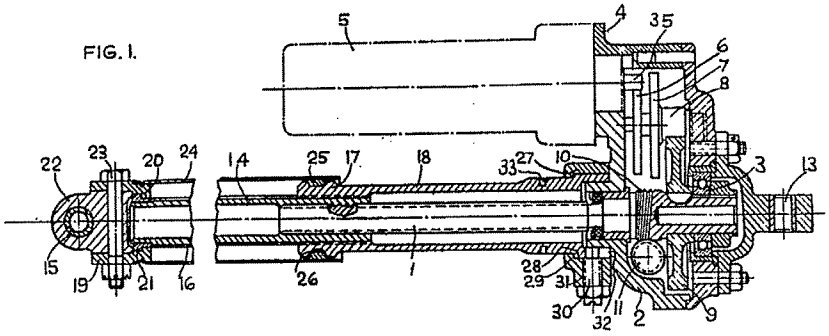
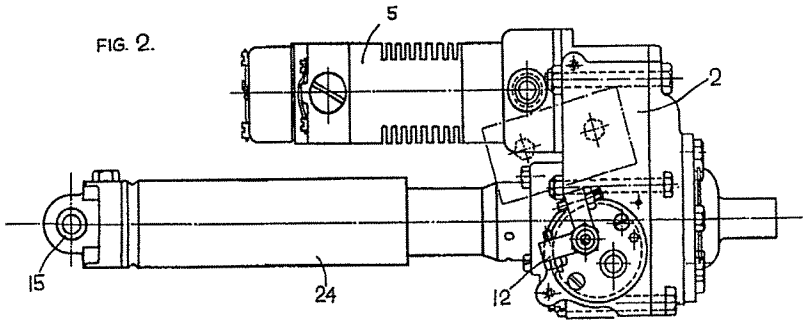


FIG. 2.



2 SHEETS
SHEET 2

H.M.S.O. (Ty. P.)